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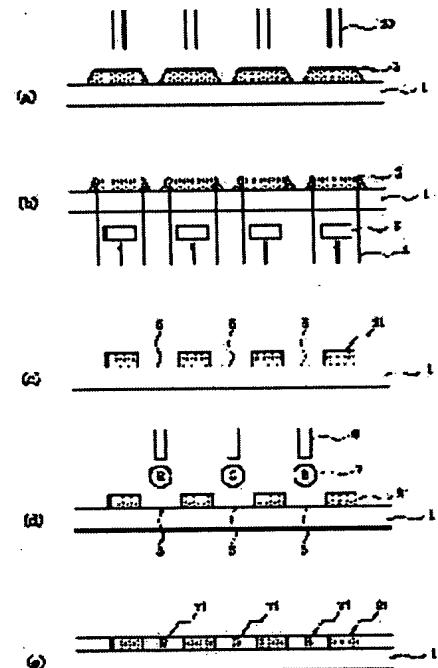
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(54) PRODUCTION OF COLOR FILTER, COLOR FILTER OBTAINED BY THE METHOD AND LIQUID CRYSTAL DISPLAY DEVICE PROVIDED WITH SAME

(57) Abstract:

PURPOSE: To reduce a production cost and to obtain a high quality color filter by forming an ink layer on a substrate by ink-jet method, irradiating the ink layer with laser beam to remove a part thereof and forming a light shielding member.

CONSTITUTION: The ink layer 2 is formed on the light transmissive substrate 1 by ink-jet method. Next, the ink layer 2 is irradiated with laser beam 4 by using a mask 3. As a result, a part of the ink layer is removed and the light shielding member 21 is selectively formed. Next, a coloring materials 7 constituting plural coloring members different in spectroscopic characteristics are arranged by ink-jet method on the region 5, where the light shielding member 21 is not formed. As a result, the color filter having the light shielding member 21 and the coloring members [e.g. R(red), G(green), B(blue)] different in spectroscopic characteristics arranged on the base material 1 is formed.



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CLAIMS

[Claim(s)]

[Claim 1] Two or more coloring members from which the spectral characteristic differs on the base which has translucency, and a protection-from-light member, The process which forms selectively, it is the manufacture approach of the light filter to constitute, and uses the ink jet method and forms an ink layer on said base, The manufacture approach of the light filter characterized by having the process which irradiates laser light at said ink layer, removes this a part of ink layer, and forms said protection-from-light member, and the process which forms said coloring member on said base with which said protection-from-light member is not formed.

[Claim 2] The manufacture approach of a light filter according to claim 1 of performing the exposure of said laser light from the field of reverse with the field in which said ink layer of said base was formed.

[Claim 3] Said laser light is the manufacture approach of the light filter according to claim 1 which is excimer laser light.

[Claim 4] formation of said coloring member — the object for the ink jet methods — ***** — the manufacture approach of a light filter according to claim 1.

[Claim 5] The light filter characterized by being obtained using an approach according to claim 1 to 4.

[Claim 6] The liquid crystal display characterized by arranging and constituting a liquid crystal ingredient between the 1st substrate which arranged the light filter according to claim 5, the 2nd substrate which arranged the pixel electrode, and **.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]**[0001]**

[Industrial Application] This invention relates to the liquid crystal display possessing the light filter and this light filter which were obtained by the manufacture approach of a light filter that a quality light filter can be manufactured, and this approach while aiming at the cutback of a manufacturing cost.

[0002]

[Description of the Prior Art] In recent years, amplification of researches and developments of a liquid crystal display is enhanced as a flat display panel, and the market size of a liquid crystal display has spread greatly.

[0003] Although it will be divided into a polarizing plate, a glass substrate, the orientation film, a liquid crystal ingredient, a spacer, a light filter, etc. if the component which constitutes a liquid crystal display is divided roughly, it is said that a light filter serves as a key point for enabling supply of the liquid crystal display of an appropriate price from a price being comparatively high also in this.

[0004] two or more coloring members from which the light filter for liquid crystal displays differs in the spectral characteristic on a transparency substrate — general — red (R) — green — (G) and a blue (B) coloring member are allotted, it is constituted, and each coloring member functions as a pixel. the protection-from-light member is prepared and general between each pixel, in order to raise display contrast — since this protection-from-light member is black, it is called the black matrix.

[0005] Laser light is irradiated at an ink layer and the pattern formation approach of the light filter which forms a black matrix pattern is indicated by JP,6-118222,A. After the approach indicated by the official report concerned applies carbon black ink the whole surface on a transparency substrate, forms a black layer, irradiates excimer laser and specifically forms a black matrix pattern in this black layer, it forms R, G, and B pattern with intaglio offset printing on it. Intaglio offset printing consists of the process which fills up the intaglio section of an intaglio with light filter ink, a process which imprints the light filter ink of the intaglio section of an intaglio with the blanket which carried out surface coating with the elastic body which makes silicone resin a subject, and an imprint process which imprints the pattern imprinted on said blanket on the substrate with which the black matrix pattern was formed.

[0006]

[Problem(s) to be Solved by the Invention] About the pattern formation approach of the light filter indicated by JP,6-118222,A mentioned above, it became clear by examination of artificers that the following technical technical problems occur. That is, in the approach indicated by JP,6-118222,A, black ink is applied also to the part (garbage) removed by spreading, i.e., laser radiation, all over a substrate in black ink, and in case a black matrix pattern is formed by laser, the clearance object of the black ink layer by laser radiation will be generated so much. The more high transmission-ization progresses and the line breadth of a black matrix pattern becomes thin, a clearance object is generated so much, it becomes dust, and, the more there is a possibility of adhering to other fields.

[0007] Moreover, although intaglio offset printing is used as an approach of printing the ink for coloring member formation on the black matrix pattern, since it consists of two or more processes about intaglio offset printing, a process will become complicated inevitably and the actual condition is not planned till the place where the cutback of a manufacturing cost is sufficiently satisfying. This invention aims at offering the manufacture approach of the light filter which solved the technical technical problem which was mentioned above, and which should be solved.

[0008] Another object of this invention is to offer the manufacture approach of a light filter that a quality light filter can be manufactured while aiming at the cutback of a manufacturing cost. Furthermore, another object is to offer a light filter without color mixture, color nonuniformity, and a color omission. Furthermore, another object is to offer the liquid crystal display which is stabilized and can display the outstanding image.

[0009]

[Means for Solving the Problem and its Function] In order that this invention may solve **** mentioned above, it inquires wholeheartedly, is made, and it is the thing of a configuration of lower-**ing). Namely, the manufacture approach of the light filter of this invention Two or more coloring members from which the spectral characteristic differs on the base which has translucency, and a protection-from-light member, The process which forms selectively, it is the manufacture approach of the light filter to constitute, and uses the ink jet method and forms an ink layer on said base, Laser light is irradiated at said ink layer, this a part of ink layer is removed, and it is characterized by having the process which forms said protection-from-light member, and the process which forms said coloring member on said base with which said protection-from-light member is not formed.

[0010] This invention includes a light filter and a liquid crystal display. The light filter of this invention is a light filter obtained by the manufacture approach of the light filter of above-mentioned this invention.

[0011] The liquid crystal display of this invention is characterized by arranging and constituting a liquid crystal ingredient between the 1st substrate which arranged the light filter obtained by the manufacture approach of the light filter of above-mentioned this invention, the 2nd substrate which arranged the pixel electrode, and **.

[0012] According to this invention, the technical technical problem mentioned above is solved and the above-mentioned object is attained. According to the approach of this invention, by forming the ink layer which constitutes a protection-from-light member using the ink jet method, and the laser light exposure to an ink layer removing a part of ink layer, and forming a protection-from-light member, simplification of a process can be attained and it becomes reducible [a manufacturing cost]. When laser light is irradiated from the rear-face side of the substrate with which the ink layer was formed, since a contaminant (clearance object by laser radiation) can prevent adhering to the field to which a pixel is constituted by the coloring member, it is quality and the light filter excellent in stability can be manufactured by the high yield. The liquid crystal display of this invention is having arranged and constituted the light filter of this invention, is stabilized and can perform outstanding image display.

[0013] Hereafter, this invention is explained, referring to a drawing.

[0014] Drawing 1 is the mimetic diagram showing one example of the manufacture approach of the light filter of this invention. In the manufacture approach of the light filter of this invention, on the base 1 which has translucency first, the ink jet method is used and the ink layer 2 is formed (drawing 1 (a)). In drawing 1 (a), 20 is the ink jet recording head (nozzle) of an ink jet recording apparatus. Subsequently, the laser light 4 is irradiated at the ink layer 2 (drawing 1 (b)). 3 is a mask. Thereby, the one section of the ink layer 2 is removed and the protection-from-light member 21 is formed selectively (drawing 1 (c)). Subsequently, the charge 7 of a coloring matter which constitutes two or more coloring members from which the spectral characteristic differs on the field 5 in which the protection-from-light member is not formed is allotted (drawing 1 (d)). In drawing 1 (d), 6 is the recording head (nozzle) of an ink jet recording apparatus, and has shown the example which uses the ink jet method for formation of a coloring member here. The light filter which allotted selectively two or more coloring members (for

example, R (red), G (Green), B (blue)) 71 from which the protection-from-light member 21 and the spectral characteristic differ is formed through such a process on the base 1 which has translucency (drawing 1 (e)). The process which can be added to the process shown in drawing 1 is explained using drawing 2 . Drawing 2 (f) shows ink fixed downstream processing performed to the light filter obtained by drawing 1 (e). It is shown by carrying out UV irradiation, EB exposure, or a heat cure, immobilization of ink is promoted by these processings depending on ink, and stability of 30 increases.

[0015] About the translucency substrate used in this invention, if it has need properties, such as transparency as a light filter for other liquid crystal of a common glass substrate, and a mechanical strength, substrates, such as plastics, are also employable. However, as shown in drawing 1 (b), to irradiate laser from the rear-face side of the substrate 1 which allotted the ink layer 2, it is necessary to penetrate laser light and the laser light which does not exceed 450nm desirably.

[0016] As an ink ingredient which constitutes translucent part material, it is the ink ingredient which can prevent the incidence of light, and although it is employable out of what can be formed by the ink jet method, the black thing of the color of ink is good.

[0017] As a concrete black ink ingredient, although carbon black ink can be mentioned, light is reflected and it can adopt out of the ingredient which absorbs laser light.

[0018] Although the method by heat energy or the method by mechanical energy is held as an ink jet method, any method is employable suitably.

[0019] The sectional view of the protection-from-light member (black matrix pattern) which used and formed the ink jet recording method in drawing 3 is shown. The cross-section configuration of a pattern consists of the flat field L section and the who field M section so that clearly from drawing. The L section and the M section become the ink to be used and the thing which changed with spreading conditions. Therefore, the flat field L is good to make into pattern formation width of face width of face which set up some more greatly, became bored by L, and **(ed) width of face M rather than desired width of face. In the ink jet recording method, control of the discharge quantity of a head or a printing pattern can adjust the L section and the M section.

[0020] The thickness of a protection-from-light member can be chosen from the range of 0.3–3 micrometers.

[0021] In this invention, it is desirable to use the ink jet method for formation of the coloring member which constitutes a pixel.

[0022] As an ink ingredient to be used, what can be used for the ink jet method is employable suitably. What suited the transparency spectrum required, for example of each pixel of R, G, and B out of various kinds of colors or a pigment as a coloring agent of ink is chosen suitably.

[0023] In this invention, either the mask imagining method or the contact mask method is employable about laser radiation.

[0024] The exposure of laser can also be performed from a transparence substrate side, and it can also carry out from the side in which the ink layer was prepared. however, clearance of the contaminant on a substrate which stops the yield of an ink layer clearance object is easy — etc. — when a point is taken into consideration, the exposure from a transparence substrate side is more desirable.

[0025] An excimer laser can be mentioned as laser used in this invention. If an excimer laser is used, since the light energy which laser light has can process a workpiece by the so-called ablation which cuts the chemical bond of a direct workpiece, it is possible for a processing cross-section configuration to become very sharp, and to process it into accuracy. As an excimer laser, wavelength can adopt the KrF laser which is 248nm, XeCl laser which is 308nm. Since it serves as a mask, and a black ink layer is not processed but it may remain when dust has adhered to the substrate side by the side of laser radiation, it is N₂ as contaminant antisticking before laser beam machining. It is good to perform a blow etc. It is good to carry out laser processing of the generated clearance object of an ink layer by laser radiation, spraying and removing gas, such as helium and nitrogen. Moreover, the clearance object of an ink layer can also be taken and removed using adhesive tape.

[0026] In this invention, fixed processing of ink can also be performed depending on the resin contained in the ink to be used. As fixed processing, UV irradiation, EB exposure, or a heat cure is employable.

[0027] If needed, a protective coat can be formed on a coloring member and a light filter can also be constituted.

[0028]

[Example] Although a concrete example is given and this invention is explained hereafter, this invention is not limited to this. This invention includes what changed and permuted the component by the well-known technique within limits by which the object of this invention is attained.

[0029] (Example 1) The ink which constitutes a protection-from-light member from a procedure shown below on the alkali-free-glass substrate (200mm angle / thickness of 1.1mm) which carried out surface polish, and the ink as a coloring member were arranged, and the light filter was produced. First, on the alkali-free-glass substrate, ink was made to inject using the so-called bubble jet recording device (BJ printer BJ[by Canon, Inc.]- equipment which converted 10 into the experiment) which generates air bubbles in ink with heat energy, and makes a liquid ink drop inject, and the grid-like ink layer (width of face of 100 micrometers, thickness of 2 micrometers, 60 micrometers of lattice spacings) was formed. The ink used here is isopropyl alcohol 11% 73.8% of BK pigment dispersing elements, and noy gene ET150 (1st industrial medicine manufacture company make) 7.4% NK ester A-400 (new Nakamura chemistry company make) 7.4% and IRGACURE 651 (Ciba-Geigy make) 0.4%.

[0030] Subsequently, KrF laser (the wavelength of 248nm, 1 J/cm² and pulse ×10) was irradiated through the grid-like mask made from Cr at the ink layer, and the edge of an ink layer was removed from the background of a glass substrate in which the ink layer was prepared. Thereby, the black stripe of the shape of a grid with the line breadth of 60 micrometers, a thickness [of 2 micrometers], and a line spacing of 100 micrometers was formed on the glass substrate.

[0031] Subsequently, the coloring ink of each color of R, G, and B prepared to the presentation shown in a table 1 was made to inject from an ink jet head, and it allotted opening of a black matrix.

[0032]

[A table 1]

表1：着色インク組成

赤インク		
赤色染料 ¹⁾	4. 5	重量部
エチレングリコール	2 0	重量部
イソプロピルアルコール	5	重量部
水	7 0. 5	重量部
緑インク		
緑色染料 ²⁾	4. 1	重量部
エチレングリコール	2 0	重量部
イソプロピルアルコール	5	重量部
水	7 0. 9	重量部
青インク		
青色染料 ³⁾	5	重量部
エチレングリコール	2 0	重量部
イソプロピルアルコール	5	重量部
水	7 0	重量部

1) CIアッシュドレッド35とCIアッシュドイエロー-23の11:3混合物

2) CIアッシュドブルー-9とCIアッシュドイエロー-23の7:2混合物

3) CIアッシュドブルー-9とCIアッシュドレッド35の9:1混合物

[0033] BEKU during 20 minutes was performed at the temperature of 90 degrees C after ink dot formation.

[0034] Thus, on the dyed layer in which the pattern of R, G, and B was formed, as a transparency protective coat, heat-curing mold resin (Mitsuhiko formation Make High Coat LC 2001) was applied so that a spinner might be used and desiccation thickness might be set to 0.5 micrometers, and the protective layer was formed by this BEKU for 30 minutes at 200 degrees C by 120 degrees C at the prebaking for 30 minutes, and a degree.

[0035] Thus, the liquid crystal display was produced using the formed light filter.

[0036] First, after forming a thin film transistor and a pixel electrode on a glass substrate corresponding to R and G which constitute the pixel of a light filter, and B pattern, the so-called active-matrix substrate which prepared the polyimide orientation film was produced.

Subsequently, ITO and the polyimide orientation film were formed as transparency electric conduction film on the light filter, and the opposite substrate was produced.

[0037] the active-matrix substrate and the opposite substrate were stuck and set through the sealing compound, and TN (the twist — nematic) liquid crystal was enclosed with the clearance between both substrates. Then, while arranging the polarizing plate on the both sides of the substrate which enclosed liquid crystal, the cold cathode mold flat-surface fluorescent lamp was arranged on the active-matrix substrate side, and the liquid crystal display was constituted.

[0038] Thus, the stable image has been displayed, when the TV signal of NTSC system was inputted into the constituted liquid crystal display and image display was performed.

[0039] Although long duration image display was performed, failures, such as color mixture, color nonuniformity, and a color omission, were not observed.

[0040] (Example 2) It explains, referring to drawing 4 about the example which considered the black matrix as the two-layer configuration. In this example, it is the big difference from an example 1 to have formed the chromium layer 8 using vacuum deposition in advance of formation of the black matrix ink layer 2 formed by the ink jet method. First, on the alkali-free-glass substrate (200mm angle / thickness of 1.1mm) which carried out surface polish, vacuum deposition and the photolithography method were used and the chromium layer 8 was formed 1 micrometer in width of face of 60 micrometers, and thickness, and in the shape of [of 100 micrometers of lattice spacings] a grid (drawing 4 (a)). Subsequently, the carbon black resin layer 2 was formed so that this chromium layer 8 might be covered on the chromium layer 8 (drawing 4 (b)). Formation of the carbon black resin layer 2 used the same ink jet method as an example 1 using what was used in the example 1 as ink. Next, with the side to which the black matrix of a substrate was allotted, laser radiation was performed like the example 1 and the edge of the carbon black resin layer 2 was removed from the reverse side (drawing 4 (c) and (d)). Subsequently, after allotting the ink coloring member of R, G, and B to opening of a black matrix like an example 1, the protective coat was allotted like the example 1 and the light filter was produced. In this way, when the liquid crystal display was produced like the example 1 using the obtained light filter, this liquid crystal display has displayed the image which was excellent over long duration.

[0041]

[Effect of the Invention] According to the approach of this invention, by forming the ink layer which constitutes a protection-from-light member using the ink jet method, and the laser light exposure to an ink layer removing a part of ink layer, and forming a protection-from-light member, simplification of a process can be attained and it becomes reducible [a manufacturing cost]. Moreover, the light filter of this invention becomes a thing without color mixture, color nonuniformity, and a color omission, and the liquid crystal display of this invention which arranged and constituted this light filter is stabilized, and can display the outstanding image.

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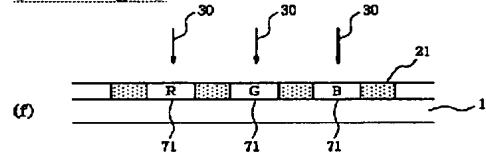
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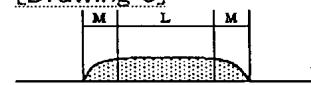
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DRAWINGS

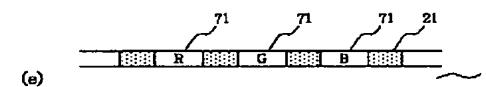
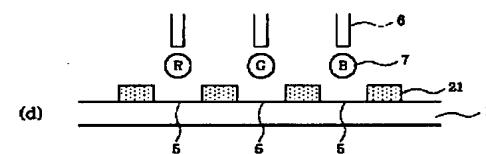
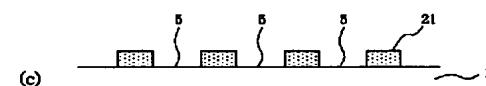
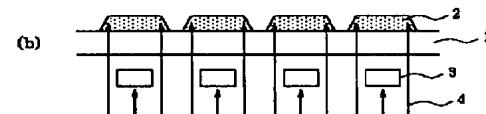
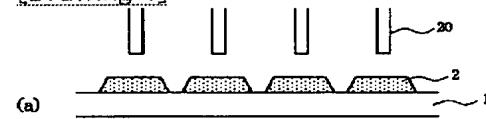
[Drawing 2]



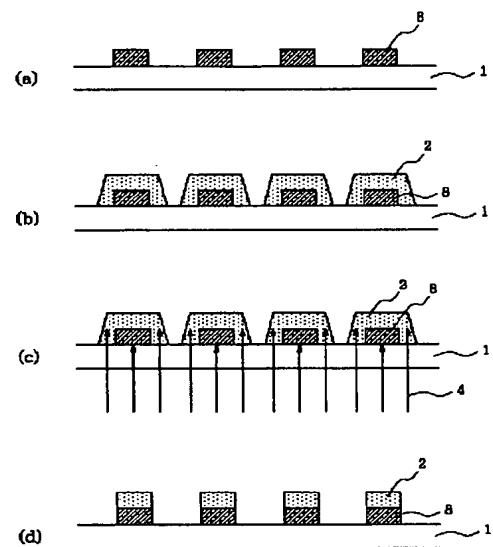
[Drawing 3]



[Drawing 1]



[Drawing 4]



[Translation done.]